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**NORFOLK HARBOR, VIRGINIA**

**REPORT OF SURVEY INVESTIGATION**

**The Craney Island**

**Disposal Area...**

**Replacement or Extension**



OCTOBER 1974

# Syllabus

The purpose of this survey was to investigate the current project for Norfolk Harbor, with a view to providing a replacement for or extension to the Craney Island Disposal Area.

The Federally authorized disposal area at Craney Island was completed in 1957. Since that time, it has received the spoil generated by maintenance, private, and permit dredging activities in Norfolk Harbor. At present (1974), the area has an estimated 5 or 6 years of useful capacity remaining before its complete filling is a reality. The necessity for maintaining a disposal area has been expressed by various public and private agencies, particularly, those engaged in protection and enhancement of the port economy and the area's valuable marine environment.

Various plans which have the potential to replace the Craney Island Disposal Area were analyzed. This report discloses that the most practicable and feasible plan for future disposal of spoil material is also consistent with the desires of local interests.

The recommended plan has two parts. The first involves the continued use of Craney Island by relocating inward and gradually raising its containment levees. The action of raising would be accomplished gradually as the need for capacity developed. This plan would extend the useful life of Craney Island by some 11 years. Part 2 involves detailed studies necessary for development of a long-range plan of disposal. No initial outlays would be required to accomplish the recommended levee raising, as

the effort would be accomplished as a normal maintenance task. The estimated annual charges for this action would amount to \$393,000. With estimated annual benefits of \$6,400,000, the project is easily justified on a benefit-to-cost basis. The recommended additional studies would cost an estimated \$4,000,000.

It is therefore recommended that, subject to certain conditions of non-Federal cooperation, the foregoing plan of improvement be adopted as a modification of the existing Federal project for Norfolk Harbor. Non-Federal interests will be required to furnish 100 percent of the maintenance funds for constructing interior levees, currently estimated at \$240,000 annually. The United States will assume responsibility for operation of the facility currently estimated at \$153,000 annually, and will accomplish all necessary studies leading to selection of a long-range plan.

# NORFOLK HARBOR , VIRGINIA

## REPORT OF SURVEY INVESTIGATION

### THE CRANEY ISLAND DISPOSAL AREA

#### Replacement or Extension

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*4 October 1974*

**NORFOLK HARBOR, VIRGINIA**  
**REPORT OF SURVEY INVESTIGATION**  
**THE CRANEY ISLAND DISPOSAL AREA**  
**Replacement or Extension**

*The Study and Report*

Hampton Roads, including the ports of Norfolk, Portsmouth, Chesapeake, Newport News, and Hampton, comprises Virginia's greatest port complex. Deep-draft navigation has long been a key stimulus to commercial, agricultural, and industrial development in the port of Hampton Roads. Domestic and foreign commerce in the port amounted to slightly over 71 million tons in 1970. Historically, this trade, along with the movement of naval vessels, has relied upon maintenance of project depths in the Hampton Roads channels. Such maintenance has required the annual removal of several million cubic yards of spoil and deposition of that spoil in the Craney Island Disposal Area. However, the disposal area is rapidly being filled as its design capacity and height is expected to be reached in 1978 or 1979.

## **PURPOSE AND AUTHORITY**

Recognizing the importance of the Craney Island Disposal Area and the need for a suitable replacement, the Committee on Public Works of the U. S. House of Representatives adopted a resolution on 3 October 1968 requesting that this study be made.

## **SCOPE OF THE STUDY**

The studies presented in this report encompass dredging and spoil disposal needs for channels and anchorages in the Hampton Roads Area. However, the choice of alternative disposal sites was not restricted to the immediate area, or to only sites which would accommodate spoil from current dredging methods. A number of dredging and disposal plans were considered. Several of them were discarded early in the study as they were found to be seriously deficient on either economic or environmental grounds, or both. Detailed analysis of the remaining plans was accomplished with a view to the technical, economic, environmental, and social needs of the study area.

## **STUDY PARTICIPANTS AND COORDINATION**

The Corps of Engineers had the responsibility for conducting and coordinating the study. This included plan formulation, consolidation of information presented by other agencies and interests, and preparation of the report. Key assistance was furnished by several agencies of the state of Virginia. Other participants in review on formulation matters, environmental issues, social impacts, and economics, included local and regional planning agencies; private consultants; the Waterways Experiment Station in Vicksburg, Mississippi; and local research interests.

Additionally, the District Engineer coordinated the study with the U. S. Fish and Wildlife Service, the Environmental Protection Agency, and the U. S. Geological Survey. Views of the public were obtained at an initial meeting held 10 September 1970, a formulation stage public meeting held 1 June 1972, and a late-stage public meeting held 28 August 1974.

### **THE REPORT**

Results of the study have been arranged into a main report and 3 appendices. The main report is an abridged, nontechnical presentation concerning the need for a disposal area in Hampton Roads and considerations involved in fulfilling that need. Appendix 1 is an expansion of the main report for the benefit of the technical reviewer. Appendix 2 includes the comments and views of those agencies -- public and private -- that expressed interest in the study. Appendix 3 contains the pertinent reports of other agencies.

### **PRIOR STUDIES AND REPORTS**

In 1944, the Congress authorized a study to determine the advisability of providing a disposal area to accommodate dredged material from the channels in Norfolk Harbor and adjacent waters. A report on this study was submitted to Congress in 1945 with the result that a Federal project, the Craney Island Disposal Area, was authorized by the River and Harbor Act of 1946.

# Resources and Economy of Study Area

Often an understanding of natural and human resources, as well as developmental trends in an area, proves to be helpful in identifying regional problems and needs. Hampton Roads is generally recognized as the southernmost boundary of the Boston-New York-Washington complex of industrial, commercial, residential, and recreational developments. Within the study area are the headquarters of the Fifth Naval District, which is the largest naval concentration in the world; the Newport News Shipbuilding and Drydock Company; 28 miles of oceanfront; over 50 miles of bay front; several hundred square miles of lake, bay, and inland waters; several hundred thousand acres of farmland; and an excellent network of air, water, rail, and highway systems and services. Population in Hampton Roads grew from about 589,000 in 1950 to approximately 1,036,000 in 1970. Of principal importance to the economic base of the area are agriculture, Government installations, manufacturing, port activities, and tourism. Hampton Roads is the principal U. S. outlet for exportation of bituminous coal, mined in western Virginia and West Virginia.



# *Environmental and Natural Resources*

Hampton Roads is characterized by a temperate climate and level terrain. Average temperatures range between 42 degrees in January and 78 degrees in July. Precipitation averages about 43 inches annually. Tidal fluctuations normally range between 1 foot below to 1.8 feet above mean sea level datum. During severe hurricanes or northeast storms, tidal levels exceeding 8 feet m.s.l. have occurred.

The foremost natural resource in Hampton Roads is the harbor itself. A naturally protected, easily accessible ocean artery, the harbor offers numerous navigational opportunities to its varied users. Historically, the harbor has been the home port of naval activities since the Civil War. Its location along the mid-Atlantic seaboard permits ready access to European and South American ports. The harbor's size and location are incentives to recreational boating activities. In one way or another, the harbor affects the social and economic well-being of the people in the entire study area.

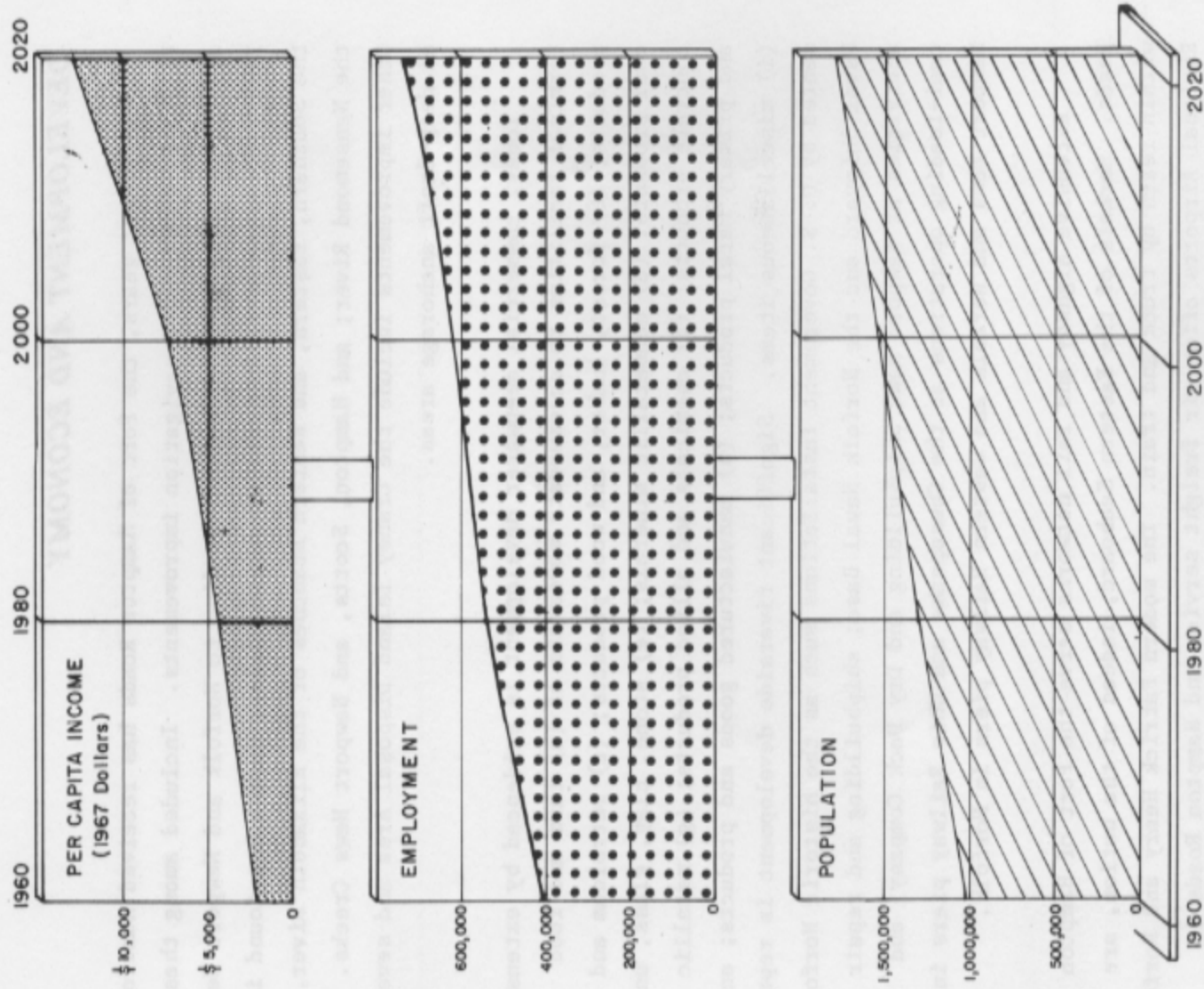
Other natural resources of importance to the area include wide beach areas along the Atlantic Ocean and Chesapeake Bay, rich farmland, as well as an extensive network of coastal, estuarine, and bay areas. The beach areas are the hub of tourist activities for which the study area is well known. Rich farmland has long been a key resource of the region, but is slowly succumbing to the expansion of suburban areas. Native waters annually yield a multitude of seafood products, thus satisfying the desires of thousands of commercial and recreational fishermen. Deposits of sand, gravel, and marl abound for commercial usage. An estimated 300,000 acres of commercial forest land are located within the study area.

In addition to the many natural attractions for tourist patronage in Hampton Roads, the area has a rich endowment of historical resources. Some sites, such as Cape Henry and Jamestown, date to the first settlement of English-speaking colonies in the New World, while many other historical attractions date to Colonial Williamsburg and the Revolutionary War era.

## **HUMAN RESOURCES**

The Hampton Roads area is the second largest metropolitan complex in the state of Virginia. The population of the area grew from approximately 864,000 in 1960 to nearly 1,036,000 in 1970. The Federal Government is the largest employer in the area. Other primary activities are services, shipbuilding, manufacturing, wholesale and retail trade, and tourism. In recent years, the unemployment level has maintained a rate less than the national average of 4-6 percent, decreasing from 3.5 percent in 1960 to about 2 percent in 1970.

Based on 1970 census estimates, the median school year completed by the 25-year or older segment of Hampton Roads population was 11.8. This was slightly above the state average for 1970 of 11.7. Opportunities for educational advancement in the area are offered by three four-year colleges, a vocational training school, and several business schools. An indication of the projected future growth in population, per capita income, and employment in the tributary area is shown in the following illustration.



Projected Income, Employment, and Population

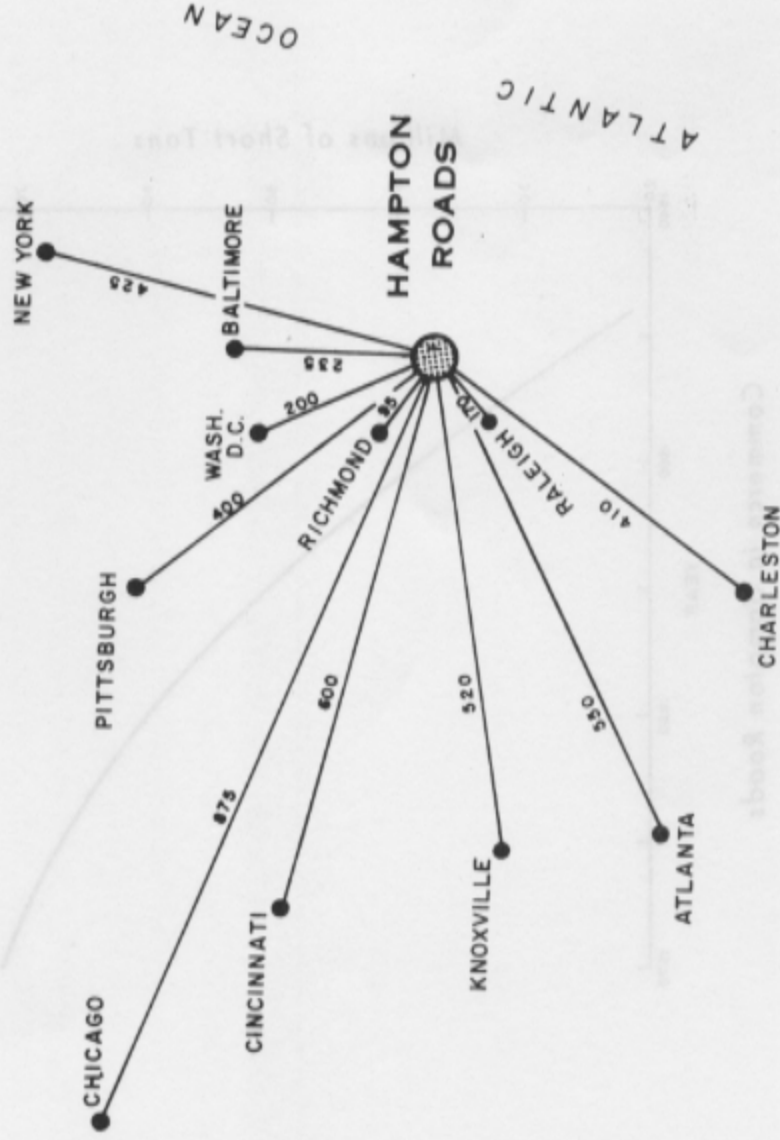
Hampton Roads Area

## DEVELOPMENT AND ECONOMY

In recent years, the Port of Hampton Roads has received numerous Federally-constructed navigation improvements. Included among these are the existing 45-foot channels leading to Norfolk and Newport News. Federally constructed channels of varying lesser depths are found in the Southern, Eastern, and Western Branches of the Elizabeth River, the Nansemond River; and Hampton, Scotts, and Newport News Creeks. Other improvements include the Craney Island Disposal Area and several deep-draft anchorage areas.

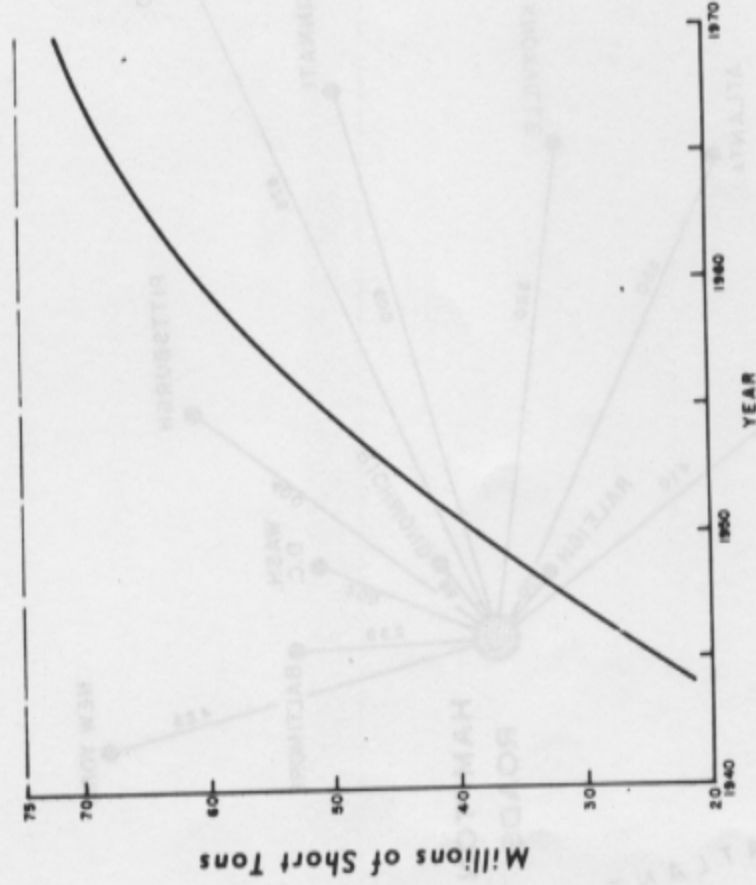
Today, commercial deepwater development is evidenced by extensive terminal facilities to accommodate movements of (a) farm and food products; (b) forest, lumber, and wood products; (c) petroleum and coal products; (d) nonmetallic minerals; (e) stone, clay, glass, and concrete products; (f) chemicals and allied products; (g) metallic and primary metal products; (h) manufactured goods and products; and (i) miscellaneous items. Significant riverside development is represented by U. S. Government installations such as the historic Norfolk Naval Shipyard and the Norfolk Naval Base; shipbuilding and repair activities at Newport News Shipbuilding and Dry Dock Company; and coal-loading operations at the Chesapeake and Ohio Railway piers in Newport News and Norfolk and Western Railway piers in Norfolk.

Extensive highway and rail networks serve the Port of Hampton Roads. Markets of the Eastern Seaboard, indeed of the nation, are within reach by truck and train. The modern Patrick Henry and Norfolk Regional Airports offer air freight service and Hampton Roads is accessible to seaports throughout the world.



### Highway Mileage to Major Cities

While there have been fluctuations in the volume of waterborne commerce reflecting changing economic conditions throughout the world, the overall trend has been upward, as shown in the following illustration. In 1970, commodity movements through Hampton Roads exceeded 71 million tons.



Commerce in Hampton Roads

Commercial vessels of the 100,000 deadweight tonnage class, with partially loaded drafts approaching 45 feet, operate from terminal facilities on the 45-foot channels in Hampton Roads. Other commercial vessels of 35,000 deadweight tons, with loaded drafts of 35 feet, operate on the existing 35 and 40-foot channels of the harbor. Also, large naval vessels move upstream along the 40-foot channel of the Southern Branch and berth at the Norfolk Naval Shipyard. The Atlantic Intracoastal Waterway begins at the 600-foot square turning basin at the upper end of the Southern Branch's 35-foot channel and the waterway serves both recreational and commercial craft. Commercial traffic therein is largely composed of towed barges.

# Problems and Needs

## STATUS OF HARBOR DEVELOPMENT

The natural benefits of size, location, ocean accessibility, and a system of deep-draft navigation facilities have all been responsible for the current substantial commerce enjoyed by the Port of Hampton Roads -- one of the most important harbor complexes in the world. However, channels, anchorages, and pier facilities require continued maintenance to remain responsive to navigation needs. Therein lies the problem to which this study addresses itself. Required dredging creates the need to dispose of millions of cubic yards of material each year. With a rapidly diminishing capacity at the existing Craney Island Disposal Area, the problems and needs are obvious -- where and how will future dredged material be disposed of.

## THE NEED FOR DREDGING

Prior to any dredging improvements, natural depths in Hampton Roads were as follows:

- Elizabeth River opposite Sewell Point - - - - 21 feet
- Mouth of Eastern Branch - - - - - 15 feet
- Southern Branch - - - - - 12 to 18 feet
- Western Branch - - - - - 12 feet
- Channel to Newport News - - - - - 25 feet

As in most coastal ports, increasing traffic and the growth of commerce in Hampton Roads created demands for navigation improvement of the harbor. The first Federal project for Hampton Roads was adopted in 1876, and provided for navigation improvements to a depth of 25 feet in Elizabeth River and portions of the Eastern and Southern Branches. Since this first Federal project, the Congress has authorized numerous other improvements, including periodic maintenance of project depths. The existing project, authorized by the River and Harbor Act of 27 October 1965, provides for a main channel depth of 45 feet to the major port facilities of both Norfolk and Newport News. A study is currently being conducted to determine the need for modifying the project depths, and is scheduled for completion in fiscal year 1975.

### ***TYPES OF DREDGING AND DREDGING PLANTS***

All dredging considered in this report may be classified as either new work or maintenance work. "New work" is that dredging which will increase the official project depth of a navigation improvement. "Maintenance dredging" pertains to removing all sediment from these improvements so as to maintain the original project depth.

Dredging in Hampton Roads is accomplished by three types of plants. These include (1) the hopper dredge, (2) the hydraulic pipeline dredge, and (3) the bucket dredge. Dredging involving large quantities of material is normally accomplished by hopper or hydraulic pipeline plants. Jobs of smaller quantities or in constricted working areas are normally accomplished by the bucket dredge.

## **THE NEED FOR SPOIL DISPOSAL**

In the earliest days of dredging, open-water disposal was the common practice. Sites in the harbor near the existing Craney Island and in the Lafayette River were used. By the turn of the century, the quantity of material being dredged had increased, and a disposal site outside the harbor (off Willoughby Shore) was utilized. Later, and with bulkheading, more extensive use was made of the original Craney Island area. Other sites were developed near the Lynnhaven River and north of Thimble Shoal channel, and used until security reasons and amphibious activities during World War II curtailed disposal here. Dredging continued during the war and material was deposited in two areas west of the entrance to Hampton Roads (opposite Newport News-Hampton). However, these areas were filled by the war's end.

Near the end of World War II (1944) the Congress authorized a study to determine a more permanent and lasting means for disposing of dredged material from Hampton Roads. As a result, development of the present disposal area at Craney Island was recommended and approved by the Congress. Actual construction of the area was completed in 1957. When completely filled in the late 1970's, Craney Island will have received some 125 million cubic yards of polluted dredged material. The resultant filling will have produced a valuable waterfront area of some 2,500 acres within the heart of Hampton Roads.

## **FUTURE DREDGING AND DISPOSAL NEEDS IN HAMPTON ROADS**

Selection of a replacement for the Craney Island Disposal Area is vitally dependent upon knowledge of estimated quantities of spoil from (a) future maintenance in Hampton Roads; (b) future and additional deepening of channels and anchorages in Hampton Roads; and (c) future dredging from slips and piers, or that which will be accomplished by

the Commonwealth of Virginia. Estimates of future maintenance dredging quantities were determined from a study of previous records of dredging. Maintenance dredging is often accomplished on an irregular (as needed) basis; however, all maintenance quantities were converted to an annual rate. The total annual estimate of material to be deposited in Craney Island, including maintenance and new work, is exclusive of dredging from Thimble Shoal Channel. In the past, material from Thimble Shoal Channel has generally been deposited in open water off Cape Henry. It is assumed that this action will continue throughout the life of the new disposal area. The following table presents the estimated future quantities of maintenance deposition, based upon results of the aforementioned study.--

#### ESTIMATED ANNUAL MAINTENANCE

| <u>Item</u>                                    | <u>Quantity<br/>in cubic yards,<br/>place measure</u> |
|--|---|
| Norfolk Harbor Channels and Anchorages         | 2,013,000   |
| Newport News Channel and Anchorages            | 206,000   |
| Naval Shipyard                                 | 42,000  |
| Craney Island Rehandling Basin                 | 341,000   |
| Permit Activities (a)                          | 1,219,000   |
| Total to be deposited in<br>disposal area      | 3,821,000   |
| Thimble Shoal Channel - Open-water<br>disposal | 311,000   |

(a) Includes all dredging (Federal and state agencies, local entities or private interests) not accomplished by Corps of Engineers.

The current study of major channels in Hampton Roads considers the deepening of Norfolk Harbor and Newport News Channels from 45 to 55 feet, and the Southern Branch of Elizabeth River Channel from 35 to 40 feet. The report also identifies several anchorages adjacent to these channels which should be dredged or enlarged to depths ranging from 35 to 55 feet. All material generated by this new-work dredging within Norfolk Harbor would require confined disposal. The following table summarizes the quantities involved.

NEW WORK DREDGING QUANTITIES (a)

| Project           | Quantity of material,<br>(1,000,000 cubic yards) |
|-------------------|--|
| <u>CHANNELS</u>   |  |
| Norfolk Harbor    | 30.6   |
| Newport News      | 11.2   |
| Southern Branch   | 2.6  |
| <u>ANCHORAGES</u> |  |
| To 55 feet        | 5.4  |
| To 50 feet        | 6.2  |
| To 45 feet        | 12.7 (b)   |
| To 35 feet        | 12.5   |
| Total             | 81.2   |

- (a) Does not reflect material from Thimble Shoal Channel, which is suitable for deposition at sea.
- (b) Includes an allowance for deepening two previously authorized anchorages from 40 to 45 feet.

## DEPOSITION IN CRANEY ISLAND

### REPLACEMENT OVER 50-YEAR PROJECT LIFE

Maintenance dredging quantities have been estimated to average some 3.8 million cubic yards per year for the 50-year project life. New work quantities have been estimated at 81.2 million cubic yards from a possible 55-foot channel and anchorage area project in Norfolk Harbor. Additional maintenance would be required to maintain the 55-foot project. This is estimated to average 1.4 million cubic yards on an annual basis, as shown in the following table.

ADDITIONAL ANNUAL MAINTENANCE (a)

| Project               | Quantity of material,<br>(1,000 cubic yards) |
|-----------------------|--|
| <u>CHANNELS</u>       |  |
| Norfolk Harbor        | 550  |
| Newport News          | 75   |
| Upper Southern Branch | 162  |
| <u>ANCHORAGES</u>     |  |
| To 55 feet            | 150  |
| To 50 feet            | 27   |
| To 45 feet            | 216  |
| To 35 feet            | 190  |
| Total                 | 1,370  |
| Rounded               | 1,400  |

(a) Does not reflect maintenance of Thimble Shoal and Atlantic Ocean Channels.

It is assumed that provision of deeper channels and anchorages would take 10 years, and that additional maintenance would begin in the

eleventh year of a 50-year life. The lump sum quantities of existing maintenance, new work, and increased maintenance would be the following:

- 3.8 million cubic yards per year for 50 years, or 190 million cubic yards for existing maintenance.
- 81.2 million cubic yards of new work.
- 1.4 million cubic yards per year for 40 years, or 56 million cubic yards for increased maintenance.

Based on current estimates, the required disposal capacity for dredged material in Hampton Roads will amount to 327 million cubic yards, over the next 50 years.

### **CHARACTERISTICS OF DREDGED MATERIAL**

In 1971, the Environmental Protection Agency (EPA) issued criteria by which it would determine the degree of pollution and acceptability of dredged material for open-water disposal. The criteria were expressed in terms of certain pollution parameters and acceptable levels of concentration thereof. The pollution parameters to be used consisted of (a) volatile solids, (b) chemical oxygen demand, (c) total Kjeldahl nitrogen, (d) oil-grease, (e) mercury, (f) lead, and (g) zinc.

In the fall of 1971 and summer of 1972, the Virginia Institute of Marine Science (VIMS) was contracted to conduct a series of surface and core sample tests of sediments in the major channels of Hampton Roads. Preliminary results from the VIMS sampling study indicated that, based on the open-water disposal guidelines of EPA,

no open-water disposal for the sediments in the Norfolk Harbor Channels could be allowed. The study indicated that nearly all of the sediments handled in Norfolk Harbor dredging and disposal operations are highly polluted with respect to the parameters studied. Of all channels tested, the Elizabeth River Channels (Norfolk Harbor 40 and 45-foot channels) appeared to be the most heavily polluted. The Newport News Channel followed in terms of degree of pollution, while the Thimble Shoal was essentially nonpolluted.

### **THE DISPOSAL AREA PROBLEM**

From the time of earliest dredging and disposal operations in Hampton Roads, through construction and filling of the disposal area at Craney Island, until the present, the character of development (waterfront and inland) in Hampton Roads has drastically changed. With the local view that land is becoming a limited and precious commodity, any proposal for a large land disposal area would be received with the utmost skepticism. Nor can 4 square miles of the harbor's water surface be continually committed every 20-25 years without the eventual filling of the harbor coming into view. Furthermore, the need for environmental protection and limits on open-water disposal operations are vital considerations. With the reality that dredging in Hampton Roads must be continued, the consideration of all views and selection of a satisfactory solution must be achieved.

# *Formulating a Plan*

Formulation of a plan to functionally replace the Craney Island Disposal Area involved consideration of a number of alternatives. Each plan was considered on the basis of its costs, benefits, environmental and social factors, and ability to best respond to the dredging and disposal needs of the study area.

## *PLANNING OBJECTIVES*

The following were planning objectives in this study:

- Provide a disposal area to receive dredged material from maintenance and new work dredging activities in Hampton Roads, for a period of 50 years, commencing at the time when Craney Island Disposal Area is filled to design capacity.
- Minimize the destruction of bottomlands, wetlands, coastal zones, and marine life resources in the Hampton Roads area.

## *FORMULATION AND EVALUATION CRITERIA*

It is the responsibility of the reporting officer to recommend the alternative that is in the best overall public interest, considering the planning objectives, the benefits and costs, and the significant economic, social, and environmental effects. In this regard, the following set of criteria were developed in an effort to assure that a fair and objective appraisal of the merits and disadvantages of the various alternatives could be accomplished.

The criteria by which all alternative plans were considered are briefly summarized in the following sentences:

- The plan should be capable of handling all types of dredged material, in small or large quantities, and be able to accommodate all types of dredging equipment.
- The system should function effectively in adverse weather conditions, be capable of continued operation if a portion of the system is damaged, and if located in overboard areas have levee construction to a height sufficient to withstand storm tides and wave action.
- The plan should have a useful life of at least 50 years.
- The plan should be publicly acceptable, be adaptable to public needs, and exhibit salvage or land reclamation benefits.
- The plan should possess minimal adverse environmental effects, conform to existing public health standards, be safe with respect to operations on or adjacent thereto, and be as aesthetically pleasing as possible.
- The plan should minimize the commitment of natural resources and avoid damage or destruction of important historic or cultural resources.
- The plan should be consistent with local, regional, state, and national plans for port and industrial growth, land use, solid waste management, water and pollution abatement, transportation, and recreation.

- The selected plan should be competitive with other plans regarding the total cost, operation and maintenance, replacement, a rapid cutback in costs if the load is reduced, and the overall economic impact on the surrounding area.

Certainly no plan could be expected to fully satisfy all criteria stated. The overall favorable response to application of criteria is thought to be a measure of each plan's merit. Selection of the best plan (or plans) emphasizes optimization in terms of technical, cost-performance, environmental, and social parameters.

### **POSSIBLE SOLUTIONS**

Possible solutions to the problem of spoil disposal in Hampton

Roads include:

- Reducing the amount of material to be dredged.
- Conventional dredging with open-water disposal, or confinement within an area similar to the present site.
- Recycling material to land from whence it originated.
- Reclamation of marginally useful land.
- Commercial usage.

It is not economically feasible or practical to appreciably reduce or stop dredging in Hampton Roads. Certainly maintenance dredging could be reduced at the expense of losing some cargo trade. However, the existing project dimensions must be maintained in the interest of national defense to accommodate large naval vessels.

The possibility of reducing the required rate of maintenance dredging by reducing the rate of shoaling is an interesting idea. However, effective use of this plan would require extensive knowledge of the source of the shoal material or the mechanism of its transport and deposit.

In Hampton Roads, conventional means of dredging would include hopper, hydraulic pipeline, and mechanical pipeline dredging. For many years a conventional means of disposal has been in open water. Knowledge that much of the spoil in Hampton Roads is polluted and could adversely affect the environment of open-water areas would prohibit unrestricted use of this means of disposal in the future. It is assumed that ocean disposal of good quality (nonpolluted) material, as that which comes from Thimble Shoal Channel, can be continued. With regard to pollution abatement, the better solution to the problem of spoil disposal is in using an area such as the existing Craney Island Disposal Area. At such a site, spillways or sluices are used to control effluent density and effect a more positive retention of all material.

Another possible solution for disposal of dredged material is to seek some means for its beneficial use rather than characterizing it as a "waste to be disposed of." Some possible uses in this manner would include (a) agricultural, construction, lowland, or topsoil fill; (b) creation of marshland; (c) rehabilitation of blighted areas such as strip mines, eroded areas, borrow pits, and gravel pits; (d) creation of hills or islands for aesthetics, recreation, residential-industrial- or commercial development, and others. The greatest drawback to this solution is in developing a technically possible and economically feasible plan or combinations of plans,

whose useful life would amount to at least 50 years, and whose capacity could accommodate an estimated annual input of several million cubic yards of dredged material.

### **ALTERNATIVE PLANS CONSIDERED**

The following plans were considered for disposal of dredged material:

- Raising existing levees at Craney Island.
- Westward extension of existing Craney Island with levees to 17 feet, m.s.l.
- Westward extension with raised levees to elevation +29 feet, m.s.l.
- Willoughby Bay.
- Ocean View Area.
- Hampton Flats.
- Ragged Island.
- Horseshoe Area off Buckroe Beach.
- Chesapeake Bay.
- Nansemond County.

- Disposal at sea.
- Truck haul to abandoned borrow pits.
- Inland disposal by rail haul.
- Do nothing.

Succeeding paragraphs will discuss the major features of each aforementioned plan, and identify major advantages and disadvantages. The following table summarizes major design features, construction quantities, and cost estimates. Reference to plate 3 will provide an overview of the disposal areas considered.

The plan to raise levees at the existing Craney Island Disposal Area would shift the location of the levees inland about 1,000 feet and increase the design height of the levees from 17.0 to 29.0 feet m.s.l. The capacity of the area would be enlarged by about 42 million cubic yards, and the useful life extended by about 11 years. The levees would be built up gradually using select fill from the disposal area. There would be no initial outlay for this plan. Annual charges for the gradual levee construction would amount to \$393,000. The major advantages of this plan would be (1) the existing rehandling facilities at Craney Island could be used, (2) no additional land would be required, (3) present dredging methods could be continued, (4) the first cost would be relatively small in comparison with other plans, and (5) there would be minimal adverse environmental impacts. Primary disadvantages of the plan include (1) its short useful life, delaying a realization of the area's development potential; and (2) the existing problems of disposal area operation, viz., odor, aesthetics, and visual obstructions.

SUMMARY OF PROJECT AND COST DATA OF VARIOUS ALTERNATIVE  
AREAS FOR FUTURE DISPOSAL

| Item                 | A                  | B                  | C                         | D              | E               | F             | G             | H             | I              |
|----------------------|--------------------|--------------------|---------------------------|----------------|-----------------|---------------|---------------|---------------|----------------|
| Raise existing levee | Westward extension | Westward extension | Westward extension raised | Willoughby Bay | Ocean View area | Hampton Flats | Ragged Island | Buckroe Beach | Chesapeake Bay |

| PROJECT DATA | Elevation, ft., m.s.l. | Initial | Ultimate | Area, acres | Capacity, million cubic yards | Levee length, ft. | Useful life, yrs @ 3.8 million cubic yards per year | PROJECT COST (\$1,000) | Initial investment | Annual charges | Annual dredging cost | Total annual charges | Cost per cubic yard |
|--------------|------------------------|---------|----------|-------------|-------------------------------|-------------------|---|------------------------|--------------------|----------------|----------------------|----------------------|---------------------|
|              | +17                    | - 8     | +17      | 2,380       | 115                           | 36,000            | 11  | 12,500                 | -                  | 400            | 3,600                | 4,000                | \$1.05              |
|              | +17                    | +26     | +17      | 2,380       | 46                            | 36,000            | 30  | 4,000                  | -                  | 400            | 3,600                | 4,800                | \$1.30              |
|              | -10                    | +17     | +17      | 1,280       | 60                            | 15,000            | 12  | 5,500                  | 12,600             | 1,400          | 4,100                | 5,500                | \$1.05              |
|              | -24                    | +17     | +17      | 4,500       | 301                           | 60,000            | 16  | 8,400                  | 60,800             | 4,200          | 4,200                | 8,400                | \$1.40              |
|              | -11                    | +17     | +17      | 1,800       | 90                            | 43,000            | 79  | 7,200                  | 27,300             | 2,500          | 4,700                | 7,200                | \$2.20              |
|              | + 3                    | +17     | +17      | 2,320       | 64                            | 64,000            | 24  | 7,000                  | 13,600             | 1,600          | 5,400                | 7,000                | \$1.90              |
|              | -14                    | +17     | +17      | 6,100       | 340                           | 63,000            | 17  | 10,400                 | 59,300             | 4,100          | 6,300                | 10,400               | \$1.80              |
|              | -28                    | +17     | +17      | 2,980       | 216                           | 48,000            | 89  | 6,000                  | 83,100             | 5,500          | 6,000                | 11,500               | \$2.70              |
|              |                        |         |          |             |                               |                   | 57  |                        |                    |                |                      |                      | \$3.00              |

SUMMARY OF PROJECT AND COST DATA OF VARIOUS ALTERNATIVE

AREAS FOR FUTURE DISPOSAL (Cont'd)

|                                      | P | O | N | M | L | K | J | Item |
|--------------------------------------|---|---|---|---|---|---|---|------|
| Inland disposal by rail              |   |   |   |   |   |   |   |      |
| Truck haul to abandoned borrow pits  |   |   |   |   |   |   |   |      |
| Sea, by special dredge, tug and scow |   |   |   |   |   |   |   |      |
| Sea, barging Pipeline to sea         |   |   |   |   |   |   |   |      |
| Sea, by hopper dredge, tug, and scow |   |   |   |   |   |   |   |      |
| from Craney Island                   |   |   |   |   |   |   |   |      |
| County                               |   |   |   |   |   |   |   |      |
| Nansemond                            |   |   |   |   |   |   |   |      |

| PROJECT DATA  |        |        |        |        |        |        |        |
|---|--------|--------|--------|--------|--------|--------|--------|
| Elevation, ft., m.s.l.                              | +20    | +47    | -      | -      | -      | -      | -      |
| Initial Ultimate                                    | -      | -      | -      | -      | -      | -      | -      |
| Area, acres   | 5,000  | -      | -      | -      | -      | -      | -      |
| Capacity, million cubic yards                       | 240    | 240    | 240    | 240    | 240    | 240    | 240    |
| Levee length, ft.                                   | 58,000 | -      | -      | -      | -      | -      | -      |
| Useful life, yrs @ 3.8 million cubic yards per year | 63     | 50     | 50     | 50     | 50     | 50     | 50     |
| PROJECT COST (\$1,000)                              |        |        |        |        |        |        |        |
| Initial investment                                  | 26,300 | (a)    | (b)    | 52,500 | 20,400 | (d)    | (e)    |
| Annual charges                                      | 4,700  | 7,500  | 9,900  | 6,400  | 1,500  | 8,700  | 15,100 |
| Annual dredging cost                                | 3,600  | 3,600  | 4,600  | 3,600  | 5,000  | 3,600  | 4,600  |
| Total annual charges                                | 8,300  | 11,100 | 11,500 | 10,000 | 6,500  | 12,300 | 19,700 |
| Cost per cubic yard                                 | \$2.20 | \$2.90 | \$3.00 | \$2.60 | \$1.70 | \$3.20 | \$4.10 |

(a) Cost based on existing unit price (Cost/c.y.) of Corps' hopper dredge and contractor's unit price for tug and scow.

- (b) Cost based on existing price to Craney Island plus contractor's unit price for barging.
- (c) Includes interest and amortization on required initial investment plus annual charges on replacements.
- (d) Cost based on existing price to Craney Island plus contractor's unit price for truck haul.
- (e) Cost based on existing price to Craney Island plus expected contractor's price for loading, transportation and final disposition.

A westward extension of the existing Craney Island Area was considered. Two levee configurations of this plan were studied. One would inclose about 1,750 acres; the other, about 2,380 acres. With a levee height of 17.0 feet m.s.l., the two configurations would provide effective lives of 20 and 30 years. Of the two configurations studied, the one with the largest capacity was used in project formulation and would have an estimated first cost of \$12,500,000. Major advantages of this plan would include (1) its centralized harbor location which would permit the continuance of present dredging and disposal methods, and (2) its economics. Major disadvantages of this plan would be (1) the loss of about 2,380 acres of submerged bottomland and water surface within the harbor; (2) the loss of marine life, marine habitat, as well as recreational and commercial usage of the affected area; and (3) the effects of the disposal area on adjacent residential areas in the form of reduced property values, unpleasant odor, poor aesthetic qualities, and visual obstruction. This plan has been strongly opposed at both public meetings on the matter by affected residents in the city of Portsmouth and by the city government itself.

Another plan would involve the raising of levees on the previously described plan for a westward extension. This plan would not come into being until the westward extension was filled to its design elevation of 17.0 feet m.s.l. At that point, levees would be moved inland an estimated 1,000 feet and be raised from 17.0 to 29.0 feet m.s.l. This plan would provide an estimated 12 additional years of useful life, giving the westward extension with raised levees a total useful life of 42 years. Annual costs of this plan to raise levees at the westward extension would amount to \$400,000. Major advantages and disadvantages of this plan would be similar to those of the plan to raise levees at the existing Craney Island.

Another plan would involve the use of Willoughby Bay in Norfolk. The levee system would inclose about 1,280 acres at a design height of 17.0 feet m.s.l. and would provide an effective useful life of 16 years. The major advantages of this plan would include (1) its convenient location adjacent to the entrance reach of Norfolk Harbor Channel; (2) the continued use of existing economical methods of dredging; and (3) the fact that, once filled, the site would undoubtedly be valuable in terms of real estate and development potential. Major disadvantages of the plan would include (1) the possible impairment of existing drainage in the area, which would require special provisions to insure its continuance; (2) the loss of 1,280 acres of a protected harbor area, with a resultant loss of marine habitat and water-oriented recreational opportunities; and (3) adverse effects on surrounding residents in the form of poor aesthetic qualities, air pollution, and decreased property values. The cost of this plan is estimated to be \$12,600,000. Opposition to the use of Willoughby Bay as a disposal area has been expressed by the populace of surrounding residential areas, the city of Norfolk, and the Navy.

Another plan of disposal would involve the construction of a confined area off Ocean View in lower Chesapeake Bay. With levees at 17.0 feet m.s.l. inclosing an area of 4,500 acres, this area would have an effective useful life of 79 years. The major advantage of this plan would be its useful life. Major disadvantages of the plan would include (1) its excessive cost of construction, which is estimated to be \$60,800,000; (2) its inconvenient location with respect to the use of current dredging and disposal practices; and (3) the permanent loss of some 4,500 acres of marine bottomland, water surface, and commercial recreation opportunities now present in the area.

Another plan of disposal would involve the construction of a confined site, known as Hampton Flats, located just southeast of Hampton and Newport News. Levees would inclose an area of 1,800 acres and be built to a height of 17.0 feet m.s.l. The effective useful life of the area would be 24 years, and its first cost \$27,300,000. The major advantage of the site would be its convenient location for continuing present dredging and disposal practices. Obvious disadvantages of this plan would include (1) the loss of 1,800 acres of productive marine habitat and water surface, and (2) loss of extensive water-oriented recreational opportunities and commercial fishing areas. This plan has been model tested at the Waterways Experiment Station in Vicksburg, Mississippi and found to produce adverse circulation currents on the Hampton Creek area. This factor is the major disadvantage.

Use of the Ragged Island area, a wetland marsh along the lower James River, was considered as a plan of disposal. A levee built to an elevation of 17.0 feet m.s.l. would inclose an area of 2,320 acres, and provide an effective useful life of 17 years. The major advantage of this plan would be its convenient location. According to the Virginia Institute of Marine Science (VIMS), the major disadvantages of this site would be destruction of localized shellfish resources as well as the elimination of a valuable and productive estuarine area. The Virginia Wetlands Act of 1972 recognizes the value of salt marshes and stipulates that wetlands destruction should be avoided.

The use of a plan to inclose some 6,100 acres off Buckroe Beach in Hampton with a 17.0-foot m.s.l. levee would produce a disposal area with a useful life of 89 years. The major advantages of this

plan would be (1) its accessibility from major channels, and (2) its long useful life. The major known disadvantage of this plan would be the loss of 6,100 acres of bottom marine land and water surface. The possibility exists that modifications to the current circulation patterns off Buckroe Beach would occur as a result of this plan. This suspicion cannot be allayed at present since the Chesapeake Bay Model (under construction by the Baltimore District, Corps of Engineers) is not complete.

A plan to construct a disposal area on the east side of the Chesapeake Bay Bridge-Tunnel complex, between the Thimble Shoal and Chesapeake Channels, was considered. Necessary levees would be constructed to an elevation of 17.0 feet m.s.l., inclose an area of 2,980 acres, and provide a useful life of 57 years. Major advantages of this area would be (1) its useful life, and (2) its accessibility from the Thimble Shoal Channel. Disadvantages would be (1) the loss of 2,980 acres of bottomland and water surface; (2) the disruption and loss of some popular fishing areas in the vicinity; (3) the restriction to current circulation patterns in the mouth of Chesapeake Bay; and (4) the excessive cost of construction, which is estimated to be \$83,100,000. Like the Buckroe Beach plan, this plan cannot be model tested for several years.

Consideration was given to a plan for constructing a disposal area some 10 miles inland of the waterfront in the city of Suffolk (formerly Nansemond County). Dredged material would be transported to the Nansemond site from a portion of the existing Craney Island Disposal Area by pipeline. Levees at the Nansemond site would be constructed to an elevation of 47.0 feet m.s.l., inclose an area of 5,000 acres, and create disposal capacity equivalent to a useful life

of 63 years. Major advantages of this plan would be (1) the convenient and continued use of dredging, disposal, and rehandling facilities at the existing disposal area; (2) the plan's useful life; and (3) the fact that the use of no new waterfront areas in the Hampton Roads harbor would be required. Major disadvantages of the plan would be (1) the loss of 5,000 acres of timber-producing swampland and wildlife habitat; (2) the disruption of natural activities of numerous native plants, animals, and birds; and (3) the possibility of saltwater seepage and intrusion into local ground water aquifers adjacent to the area.

Several methods of disposal at sea were considered. These included disposal at sea by hopper dredge and tug and scow, barging to sea from Craney Island, disposal at sea by pipeline, and disposal at sea by special dredge and tug and scow. The foremost advantage of any variation in ocean disposal would be its unlimited useful life. The unknown effect of disposing of often highly polluted material in open waters remains as the foremost item of concern with this plan, and constitutes its major disadvantage. Another disadvantage involves the considerable cost of transporting dredged material from Norfolk Harbor to sea.

A plan involving the use of truck haul of dredged material to abandoned borrow pits was considered. The material would be removed from the existing Craney Island Disposal Area. Advantages to the plan would be the continued use of existing dredging and disposal facilities, and the reclamation of otherwise useless borrow pit sites. However, the number of available pits within a reasonable distance is small, and the capacity of all of them together would be exhausted within a few years. Another difficulty of this plan would involve the need to utilize an estimated 1,000 truckloads per day.

Another method of disposal would be to utilize rail haul to a suitable inland fill site. In theory, the ideal arrangement for this plan would be to load coal cars which would otherwise be re-turning to the coal mines in southwest Virginia and West Virginia empty. The dredged material would be deposited in inactive strip mines or other land areas in need of reclamation. Major advantages to this plan would be (1) long useful life; (2) minimal impact in loss of natural resources; and (3) the continued use of facilities at the Craney Island Disposal Area, at which point the material would originally be loaded on trains. Major disadvantages of this plan would be (1) its cost -- about three times that of the westward extension of Craney Island, and (2) the unknown effect of saltwater seepage and drainage into local water systems at the point of disposition.

The "do nothing" alternative would forego the provision of a replacement to Craney Island Disposal Area when filling thereof is completed in 1978 or 1979. With the annual shoaling rate of 0.8 foot per year, only a few years would pass before channel depths would decrease to the point of creating catastrophic conditions in the economy of Hampton Roads and the Commonwealth of Virginia. The failure to provide a replacement for Craney Island Disposal Area is not believed to be a realistic consideration, and was given no further attention.

The table on page 34 is presented to summarize the major features of each of the 17 alternatives. Although other technical, economic, and environmental characteristics influenced the screening process, the table reflects the primary rationale. A word of narrative explanation is offered for several of the choices.

- With the measure only in numbers of people directly impacted, social impacts with either the Ocean View or Willoughby alternative would be much greater than those of the westward extension.

- The preliminary inclination was to reject both the Buckroe Beach and Chesapeake Bay alternatives because of the cost and commitment of resources required. However, the Commonwealth of Virginia was desirous that both sites be model tested. For this primary reason, they were retained for further study.

- Disposal at sea was retained for further study at the request of Virginia.

- There would be a risk of ground water contamination by saline effluents at the Nansemond site, borrow pits, and strip mine alternatives. At Nansemond, the problem would be technically uncontrollable, at competitive cost. With the borrow pits and strip mine plans, it would not be.

- Plan C would be impossible to implement without Plan B. For the sake of future study, these plans were combined...

On the basis of criteria as stated, and the comparison of design, cost, environmental and social features, it is concluded that 9 (10 reduced to 9) of the original 17 alternatives have sufficient potential to receive additional study. These include (1) raising the levees at the existing site, (2) raising the height of a westward extension of Craney Island, (3) utilizing the Nansemond site (4) utilizing the Horseshoe area off Buckroe Beach, (5) utilizing a disposal area in the Chesapeake Bay, and (6) disposal of material at sea (4 variations).

COMPARISON OF ALTERNATIVES

| Alternative                                  | (1)<br>Unit cost<br>per c.y. life/yr | (2)<br>Useful<br>life/yr | (3)<br>Major commitment<br>of resources | (4)<br>Major advantage                        | (5)<br>Major disadvantage   | (6)<br>Further action<br>recommended | (7)<br>Rationale for<br>further action(a)(b) |
|--|--------------------------------------|--------------------------|---|---|---|--------------------------------------|--|
| A- Raise existing<br>levee                   | 1.05                                 | 11                       | No additional land                      | Cost/convenience                              | Short life  | Detailed study                       | 1,3,4 over 5                                 |
| B- Westward extension                        | 1.30                                 | 30                       | 2,380 acres of marine<br>bottom         | Cost/convenience                              | Social impact   | Detailed study                       | 1,2,4 over 5,3                               |
| C- Westward extension,<br>raised             | 1.05                                 | 12                       | No additional land                      | Cost/convenience                              | Social impact   | Detailed study                       | 1,3,4 over 5                                 |
| D- Willoughby Bay                            | 1.40                                 | 16                       | 1,300 acres of marine<br>bottom         | Cost  | Short life/severe<br>social impact  | None                                 | 5,3,2 over 4                                 |
| E- Ocean View                                | 2.20                                 | 79                       | 4,500 acres of marine<br>bottom         | Useful life                                   | Operational inconvenience/cost/social<br>impact                                 | None                                 | 3,1,5 over 4                                 |
| F- Hampton Flats                             | 1.90                                 | 24                       | 1,800 acres of marine<br>bottom         | Convenience                                   | Causes adverse circulation of currents<br>& sedimentation                       | None                                 | 5,3 over 4                                   |
| G- Ragged Island                             | 1.80                                 | 17                       | 2,300 acres of wetland                  | Cost  | Resource Commitment<br>Req'd  | None                                 | 5 over 4                                     |
| H- Buckroe Beach                             | 2.70                                 | 89                       | 6,100 acres of marine<br>bottom         | Useful life                                   | Need model testing  | Detailed study                       | 5,4 over 3,1                                 |
| I- Chesapeake Bay                            | 3.00                                 | 57                       | 2,980 acres of marine<br>bottom         | Useful life access-<br>ibility                | Need model testing/<br>cost   | Detailed study                       | 5,4 over 1,3(c)                              |
| J- Manassas                                  | 2.20                                 | 63                       | 5,000 acres of swamp<br>forest habitat  | Useful life/con-<br>venience                  | Potential for saline<br>contamination of<br>ground water aquifer                | Detailed study                       | 4 over 5,3                                   |
| K- Sea by hopper<br>dredge                   | 2.90                                 | Unlimited                | None                                    | Useful life                                   | Need testing for pos-<br>sible adverse effects<br>on marine environment         | Detailed study                       | 4,5,3 over 1                                 |
| L- Sea by barge from<br>Crane Island         | 3.00                                 | Unlimited                | None                                    | Useful life                                   | Need testing for pos-<br>sible adverse effects<br>on marine environment         | Detailed study                       | 4,5,3 over 1                                 |
| M- Sea by pipeline                           | 2.60                                 | Unlimited                | None                                    | Useful life                                   | Need testing for pos-<br>sible adverse effects<br>on marine environment         | Detailed study                       | 4,5,3 over 1                                 |
| N- Sea by special<br>Dredge                  | 1.70                                 | Unlimited                | None                                    | Useful life                                   | Need testing for pos-<br>sible adverse effects<br>on marine environment         | Detailed study                       | 4,5,3,3                                      |
| O- Truck haul to<br>abandoned borrow<br>pits | 3.20                                 | Short life<br>(d)        | None                                    | Reclamation of bor-<br>row pit                | Useful life/Potential<br>for saline contamination<br>of ground water<br>aquifer | None                                 | 5,3 over 4                                   |
| P- Inland disposal by<br>rail haul           | 4.10                                 | 50(e)                    | None                                    | Reclamation of<br>strip mine/use-<br>ful life | Cost/Potential for<br>saline contamination<br>of ground water<br>aquifer        | None                                 | 1,5 over 2,4                                 |
| Q- Do nothing                                | 0                                    | Unlimited                | None                                    | No resource<br>commitment                     | Increase unit ship-<br>ping costs/joinerize<br>national defense pos-<br>ture    | None                                 | 5 over 4,3                                   |

(a) Numbers represent the parameter for each alternative; i.e. No. 4 represents "Major Advantage."

(b) Numbers in "Rationale" appear in order of weight influencing decision.

(c) This plan was originally rejected for reasons of cost and likely disruption of current movements within Chesapeake Bay. Since it can be made feasible by the use of a barge canal, this plan was retained for further study at the request of the Commonwealth of Virginia.

(d) A useful life of 50 years was assumed for costing purposes. In reality, total useful capacity within a reasonable driving distance is small.

(e) 50-year life assumed for costing purposes.

## **FACTORS ASSOCIATED WITH PLAN SELECTION**

The factors associated with selecting a plan of disposal for dredged material in Hampton Roads include (1) estimated annual rate of filling (3.8 million cubic yards per year); (2) the lump sum input of dredged material which would occur if a major channel and anchorage deepening project for Hampton Roads were authorized; (3) the potential total capacity and useful life of each alternative (there is a wide variance between the 9 alternatives selected for further study), considering the definite and foreseeable input of dredged material, (4) the operating cost of each plan; (5) the environmental impacts of various plans; and (6) social impacts/public sentiment. Three of these factors -- total capacity-useful life, environmental impacts, and social impacts -- are not clearly defined as they relate to selection of one final plan.

There is a wide variance in the potential useful lives of the nine plans, based on input by normal maintenance activities. Consideration of new work and increased maintenance further changes the complexion of the useful lives. The following table reflects the sensitivity of the nine plans to the three conditions of input.

COMPARISON OF USEFUL LIVES

| Plan                      | Useful life, @ 3.8 million cubic yards |     | Useful life, @ 3.8 million cubic yards plus lump sum (a) |
|---------------------------|--|-----|--|
|                           | per year                               |     |  |
| Raise levees              | 11                                     | (b) |  |
| Westward extension raised | 42                                     | 6   |  |
| Buckroe Beach             | 89                                     | 53  |  |
| Chesapeake Bay            | 57                                     | 21  |  |
| Nansemond County          | 63                                     | 27  |  |
| Sea (4 variations)        | Unlimited                              |     | Unrestricted   |

(a) 3.8 million cubic yards annually; lump sum = 81 million; new work + 56 million increased maintenance or 137 million cubic yards.

(b) Does not possess the capacity to be sensitive to this amount of input.

Combinations of the nine plans could measurably increase the total capacity and useful life available. The following examples indicate this fact.

- Raise Craney Island, westward extension raised,  
Chesapeake Bay . . . . . 74 years
- Raise Craney Island, Buckroe Beach . . . . . 64 years
- Nansemond, westward extension raised . . . . . 69 years
- Obviously, all plans involving sea disposal would have unlimited life.

### *SELECTING A PLAN*

Towards the end of the formulation process, sufficient data should normally be available to permit the selection of one plan. However, in the Craney Island study, this is not the case. Unanswered problems remain with several of the plans being considered. For example, the Buckroe Beach and Chesapeake Bay plans would need model testing before serious consideration could be given them. The Nansemond plan needs further analysis into its hydrogeologic problem of ground water contamination. Disposal at sea should be further explored since "pockets" of suitable material in Norfolk Harbor may be determined upon further exploration. The westward extension plan, though highly sensitive from a cost viewpoint, possesses social and environmental characteristics needing further study. The only plan which, at this stage of study, is reasonably acceptable from all points of view is the plan to raise levees at the existing site. Even this plan is not totally acceptable, since it is not sensitive to the long-range disposal needs involving annual maintenance and new work. The plan would last for 11 years of maintenance. It would produce minimal impacts environmentally and socially. Most importantly, it would provide sufficient time to conduct the necessary studies leading to a long-range plan.

Based upon existing data regarding the technical, economic, environmental, and social aspects of each alternative plan for replacing or extending Craney Island, it is concluded that the selected plan for replacement of Craney Island Disposal Area should be the following:

- Part 1 - Gradually raising the elevation of containment levees at the existing Craney Island from elevation +17 feet m.s.l. to +29 feet m.s.l.
- Part 2 - Accomplishing detailed studies on eight alternatives for dredge material disposal during Phase 1 investigations. These studies would permit the development of a long-range plan of disposal.

## *The Selected Plan*

This section presents an overall view of Part 1 of the selected plan, as it discusses significant design, construction, operation and maintenance aspects. Information is also presented regarding type and costs of Part II.

### **PLAN DESCRIPTION**

As previously stated, Part 1 of the selected plan provides for the continued use of Craney Island Disposal Area by gradually raising the existing levees as shown on plate 1. The existing Craney Island Disposal Area would be filled to its design elevation of approximately 17 feet above mean sea level, which at the present rate of dredged material deposition will be accomplished in 1979. When this stage of the Craney

Island project was reached, the disposal area would be further filled by relocating the confining levees inland approximately 1,000 feet, to a stable alignment. At this point, they would be gradually raised, as the need for more capacity developed. Ultimately, the levees would be raised to an elevation of 29 feet above mean sea level. This phase of the project will increase the capacity of Craneey Island by 42 million cubic yards, and extend its useful life by about 11 years, to 1990.

In Part 2, additional studies of the eight remaining alternatives would include model tests of lower Chesapeake Bay sites; social impact analyses of the westward extension, Nansemond County, and Buckroe Beach alternatives; detailed research of the ground water problem at Nansemond; additional boring and lab tests of the dredge material regarding its suitability for sea disposal; and other detailed environmental, engineering and economic studies necessary for development of a long-range plan.

### PLAN ACCOMPLISHMENTS

Four accomplishments will result from the proposed plan of improvement. They are:

- (1) Provision of a confined area for the future disposal of polluted spoil generated by maintenance dredging activities, for a period of 11 years.
- (2) Immediate provision of approximately 400 acres of property, accessible by deep water.
- (3) Ultimate provision of some 2,000 acres of land which may have many possibilities for some beneficial use.

(4) Selection of a long-range plan of disposal in Hampton Roads.

Hampton Roads, including the Ports of Norfolk, Portsmouth, Chesapeake, Newport News, and Hampton comprises Virginia's greatest port complex. For its maritime economy to continue to grow and accommodate its diversified need, the deep-draft channels in Hampton Roads must be maintained. In this connection, an adequate confined disposal area for future dredging operations must be provided. The proposed plan for continued use of Craney Island would serve this immediate need for 11 years, and ultimately for some 40 years or more.

### **EFFECT ON THE ENVIRONMENT**

Raising the existing levees would cause only a minimal adverse effect on the surrounding biological communities. Life is sparse on the existing levees whose brief period of existence, combined with the continual activity of levee construction, has not been conducive to biotic development. Animal life is predominated by gulls and other shore birds common to the Hampton Roads area. Evidence of the presence of a variety of small mammals, but in low concentration, has been noted. These forms, such as the rodents, gain access to Craney Island easily from fields adjacent to the levee site. The gradual addition of more material, with the subsequent burial and increased height of the present levees, should have no major impact on the present environment.

### **OTHER EFFECTS**

Despite its obvious advantages from the stand-point of cost, convenience, and cause-effect characteristics, Part 1 of the selected plan is not widely endorsed by the city of Portsmouth. However, most opposition to the plan is centralized in this city. Testimony by representatives of the city has repeatedly voiced the city's desire to see the present

Craney Island Disposal Area expeditiously filled to its current capacity. Portsmouth has assumed the position that, when filling is completed in 1979, ownership of Craney Island should be transferred from the Federal Government to the Commonwealth of Virginia, and then to the city. Because it is a land-locked, deteriorating core metropolitan area, Portsmouth indicates it has little to anticipate in the way of new or increased development or revenue. Yet, it must somehow attempt to cope with gradually increasing demands on its limited budget. The city maintains that industrial and commercial development on the Craney Island Disposal Area offers it the only real hope for salvaging a nearly hopeless budgetary problem.

Serious doubts are entertained as to whether any construction, particularly of a heavy industrial nature, could be accomplished on most of a filled Craney Island. If such development were possible, the material which has settled along the north and east levees would appear to be the most stable, and offer the most promise in this regard.

Regardless of developmental needs, containment levees must be relocated inland to offer necessary stability for an elevated area. This action does create strips of land along the north and east levees. The total acreage involved is about 400 plus acres. It is assumed that development on this land can be effected even as filling operations in the elevated site were ongoing. As for other effects, compatible development along the north and east levees would be a benefit to local interests, as would the maintenance dredging and disposal operations, which could be continued.

## DESIGN

Raising the existing levees of Craney Island to elevation +29 feet m.s.l. would consist of providing an interior retaining levee, 36,000 feet in length and 12 feet in height, paralleling the existing boundary limits and located within the confines of the disposal area. Before construction

of the proposed levee to elevation +29 feet m.s.l., the already authorized +17 feet m.s.l. project limits would have to be relocated to a stable alignment. This alignment would have to be located inland a distance not less than 250 feet from the centerline of the existing perimeter road, and would apply to the north, east, and west levees. After relocation of the +17 feet m.s.l. levees, interior retaining levees could be constructed to elevation +29 feet m.s.l. and would encompass the entire perimeter area, including the southern end of the existing disposal area. The centerline of the proposed levee would be located about 1,000 feet inland from the exterior levees.

Additional investigations in connection with Part 2 of the selected plan would be in the depth and detail necessary to evaluate effects, make trade-offs, and select the best long-range plan. These would include detailed, technical and environmental investigations of open-water disposal. Model tests of all offshore sites would be accomplished, as would detailed studies of socioeconomic impacts associated with siting a disposal area in a particular location. Other investigations would be conducted as needed. The ultimate selection of one area will cause irreversible impacts and substantive commitments of finite natural resources in the study area. No matter which location is eventually selected, serious and determined objections will likely occur. The objections will likely lead to challenges of the rationale for the plan formulation and selection process. Therein lies the critical need for the additional investigations recommended; i.e., the need to fully evaluate all impacts before selecting one particular plan.

## CONSTRUCTION

Assuming authorization and funds availability, relocating and elevating the levees would be a gradual action, to be accomplished over the project's 11-year life. The relocated levees would be constructed with select fill from within the disposal area.

The recommended additional investigations could be accomplished in Phase 1 efforts of the plan to raise levees at the existing disposal area.

## OPERATION AND MAINTENANCE

Operation and maintenance would be under the supervision of the District Engineer and handled in a manner similar to the existing Craney Island Disposal Area. Utilization of the area would be coordinated with the dredging requirements of the district, local interests, and other government agencies. Even though the Corps would supervise the operation and maintenance of the facility, the Federal government would only be financially responsible for the operation portion. Operation of the facility would include coordinating and scheduling of disposal permits, controlling daily water surface elevations within the disposal area, operating and maintaining the mooring facility for Corps dredges, planning equipment rental, and managing all accounts associated with the project. Maintenance funds, including those required for construction of the interior levees, would be the financial responsibility of local interests.

Users of the disposal area, other than the Commonwealth of Virginia and the Corps of Engineers, would be charged a fee for deposition of spoil. Two fees would be levied, both based on the relative capacity of the site which private dredgers used. The first fee would be for recovery of the initial investment and maintenance by the state, while the second would be to cover operation costs of the Corps.

## *Economics of Selected Plan*

This part of the report discusses the economic material utilized in the study -- costs as well as benefits. The material presented concerns the facets of the proposed improvement which can be quantified in dollar values.

### **METHODOLOGY**

In the formulation phase of this study, the various plans were carefully evaluated in terms of cost, as well as environmental and social impacts. However, the selected plan was formulated without actually computing any tangible benefits. Nevertheless, in order to show that the selected plan is economically feasible, a measure

of benefits was computed and compared with the project cost. The computed benefits and costs for the selected plan were made comparable by conversion to an equivalent time basis using an appropriate interest rate. For this analysis, an interest rate of 5-7/8 percent applicable to the public projects, and a project life of 50 years were used. The net effect on converting benefits and costs in this manner was to develop equivalent average annual values.

### ***COSTS***

The estimate of annual construction costs and other annual charges applies to Part 1 of the selected plan of disposal as formulated in previous sections of this report. All costs were updated for the purposes of this section and are based on February 1974 prices. An interest rate of 5-7/8 percent was used. The estimated annual cost for operation and maintenance includes the normal charges applicable to the disposal area itself, as well as the costs required to raise the interior levees to an ultimate elevation of +29 feet m.s.l. The following table summarizes the annual construction costs and other annual costs of the selected plan of improvement.

The additional studies recommended would cost an estimated \$4,000,000. A cost breakdown for the various study items anticipated at this time is presented in section D of Appendix 1.

### ***BENEFITS***

There is no clearly defined monetary benefit which can be attributed to the development of a disposal area in Hampton Roads. One benefit of a disposal area is in the provision of a means whereby dredged material is prevented from reentering the improved channel. Other benefits relate to environmental protection (preventing polluted spoil from reentering the marine environment), and reduction of the actual costs of dredging (depending upon the location of disposal area and distances which spoil must be transported before being deposited). The benefits

# SUMMARY OF ESTIMATED ANNUAL CHARGES

| Item | Raise existing<br>Craney Island<br>Elev. 17 to 29 |
|------|---|
|------|---|

## PROJECT DATA

Elevation, ft. m.s.l.

Initial

Ultimate

Area, acres

Capacity, million cubic yards

Useful life, based on 3.8 million  
cubic yards per year

Length of levee, ft.

Year increment to be constructed

Year increment to be filled

## PROJECT COST (\$)

Construction cost

Engineering and design @ 10%

Supervision and administration @ 8%

Total Construction Cost

Present worth of construction cost

## ANNUAL CHARGES (\$)

Interest on initial investment @ 5-7/8%

Amortization on initial investment

Replacement

Maintenance, interior levee construction

Operation

Total Annual Charges on Construction

Rounded

associated with the actual dredging process (new work or maintenance) are normally determined in a prior study of the need for navigational improvements, and related to reduced shipping costs, increased commerce, and new or additional port and industrial development. A similar approach would appear to be a logical approach, though by no means the only approach, to indicate a measure of benefits attributable to development of a disposal area. The term "measure of benefits" is used because (1) the benefits thus derived which are applicable to development of a disposal area are sufficiently in excess of the cost, so as not to warrant question of the plan's justification; (2) the value of many environmental resources is difficult to quantify in dollars; and (3) determining all direct, indirect, tangible, and intangible benefits of a disposal area would be a next-to-impossible task, as would be attempting to express such benefits in terms of a cumulative dollar value.

In this study, the method of benefit analysis selected centered on one key commodity, coal, and involved the assumption that channels in Hampton Roads shoaled to 40 feet. A constant rate of coal shipments to Japan and Europe for base year 1980 (a total of 45 million tons) was also assumed for the 45 and 40-foot depth. This rate is in keeping with the results of an August 1972 study prepared for the Institute of Water Resources. The study indicated that 12,700,000 tons of coal will move from Hampton Roads to Japan in base year 1980, while 32,300,000 tons will move to Europe. Other factors pertinent to the benefit analysis included (1) study of a three-year record (1969, 1970, 1971) of coal vessel shipments, and preparation of a 1980 (base year) fleet size distribution for coal vessels; (2) previous experience with maintenance dredging which indicated that the annual rate of shoaling in major channels of Hampton Roads is 0.8 foot; and (3) vessel unit operating costs in 1972 dollars, as supplied by the Board of Engineers for Rivers and Harbors.

The benefit analysis was prepared to reflect several basic facts. First, as channels shoaled to 40 feet, either a gradual "reversal" in the fleet size distribution of the base year would occur, or vessels unable to navigate the smaller channels would be forced to partially load. Second, the end result of either action would be an increase in the unit shipping cost.

Thus, the "measure of benefits" derived is an estimate of additional costs, accruing to shipments of coal, which would occur if channels in Hampton Roads were allowed to shoal. All evaluated benefits are based on the most recent vessel operating costs available at the time the report was prepared and are summarized in the following table. According to this procedure, the benefits realized by preventing the shoaling of channels to 40 feet would be an estimated \$6,400,000 over the 11-year life of the selected plan.

## JUSTIFICATION

The following table compares average annual benefits for the assumed condition of channel shoaling with average annual costs of the selected plan of future disposal. As previously stated, the selected plan was not formulated on the basis of computed monetary benefits. However, it should be noted that the benefits computed in this section would be the same for any plan selected. Thus, the most economical plan of improvement would be the least costly. In this case, it so happens that the selected plan is the cheapest plan.

SUMMARY OF ECONOMIC ANALYSIS RAISING EXISTING  
LEVEES AND WESTWARD EXTENSION OF CRANEY ISLAND

| <u>Item</u>                    | <u>Amount</u> |
|--------------------------------|---------------|
| <u>Average Annual Benefits</u> |               |
| Preventing shoaling to 40 feet | \$6,400,000   |
| <u>Annual Costs</u>            | 400,000       |
| <u>Economic Ratio</u>          |               |
| Shoaling to 40 feet            | 16.0          |

## *Division of Plan Responsibilities*

The purpose of this section is to present the division of responsibilities between Federal and non-Federal interests in connection with development of the proposed project. Two major items of concern are involved in the discussion -- procedures in disposition of the filled disposal area and procedures in acquisition, development, and operation of the new disposal area.

### ***DISPOSITION OF EXISTING DISPOSAL AREA***

Prior to authorization of the existing disposal site at Craney Island, the state of Virginia was required to convey to the United States title to the submerged lands underlying the disposal site. The report on this project directed that dikes and other necessary facilities be built with Federal funds. However, this Federal

investment, including interest and amortization, was to be "recovered" through the imposition of a users' toll. In determining the toll, the estimated value of the completed site (\$2.5 million) was subtracted from the amount of investment, interest, and amortization to be recouped. Thus, this \$2.5 million should be realized upon the disposition of Crane Island according to the original intent of the authorizing document. This action is uniquely different from existing policies of local cooperation in navigation improvement projects. At present, local interests must provide all lands, easements, rights-of-way, dikes, and other retaining works required for containment of spoil, etc. -- but are not required to deliver title of lands involved to the United States. Regarding the disposition of a filled disposal area at Crane Island, and its relationship to provision of a replacement disposal area, the following are possible courses of action.

The filled Crane Island could be transferred to the state in exchange for new disposal sites. Pursuant to 33 U.S.C. 558b (1970), the Corps has the authority to trade lands it has in exchange for lands required for a navigation project. Therefore, where the value of the lands for the new site were equal to the then current value of Crane Island, a simple exchange of lands could be made. If the value of the lands provided by the state were less than the value of Crane Island, then the difference would have to be made up, presumably as a cash contribution, and specific legislation would be needed in order to transfer Crane Island to the state.

The disposal area could be disposed of pursuant to the Federal Property Act, 40 U.S.C. 484 (1970). Treating Crane Island in this manner would mean that any enhancement in the value of the site which had accrued because of the deposition of spoil would inure to the

benefit of the Federal Government. In dealing with the property, the first step would be to determine whether the property was excess to Department of Army needs. If it was, then it would have to be determined if it was surplus to the needs of other Federal agencies. This would require contacting other Federal agencies; for example, the Department of Interior might have use for the land as a park or wildlife refuge, or the Department of the Navy might desire the site for a depot. If Craney Island, or some part of it, was surplus property, then it would be reported to General Services Administration and disposed of by them. Whoever wished to acquire Craney Island would then have to deal with GSA, and such a party would pay a price based upon the provisions of the Act. The state would have first option on the land if it agreed to put it to one of several specified uses, such as low income housing, park land, or use for civil defense needs.

Title of the filled disposal area could be returned to the state. As local sponsor for the plan to provide a replacement to Craney Island, the state would furnish lands, easements, rights-of-way, etc., in accordance with existing requirements of local cooperation. It is certain that benefits of the Craney Island Disposal Area have accrued to interests other than the state of Virginia. For example, the benefits of properly maintained channels (and provision of a disposal area) could logically be expanded to include the coal miners of West Virginia, shipping operators in the United States and foreign countries, the national defense in the presence of extensive naval investments in Hampton Roads, and environmental protection. Under such reasoning, the state of Virginia has been the major contributor to a mechanism whereby both the state and nation have benefited immeasurably. Therefore, title to the filled area at Craney Island could be returned to the state at no cost.

The approach which was selected evolved from a consideration of current policies and the previous approaches mentioned. In keeping with current policy, local interests would furnish all easements, rights-of-way, and containment devices required. No land would be required since the area is already Federally owned. Operation and maintenance would be accomplished by the Federal Government. The costs of annual replacement and maintenance, including the costs for levee construction, would be furnished by local interests. User fees would be levied in a similar manner to the current practice. When the elevated site was filled and no longer needed, it would be returned to the Commonwealth of Virginia, and \$2,500,000 would be realized by the Federal Treasury. Concurrent development on the 1,000-foot strip of land along the north and east levees would be allowed, provided such development was compatible and did not conflict with the adjacent filling operations.

## **FEDERAL RESPONSIBILITIES**

Currently, there would be no Federal contribution toward the construction cost of the proposed plan of improvement. However, the United States would accomplish all studies incidental to plan selection, design and prepare detailed plans, accomplish all necessary construction, and operate the disposal area. Federal actions are subject to Congressional authorization and funding, as well as timely receipt of the non-Federal share of project cost.

## **NON-FEDERAL RESPONSIBILITIES**

The current estimate of non-Federal contributions for the construction of the proposed plan of disposal is \$240,000 annually for

11 years. This amounts to a one-time payment of \$1,900,000. Prior to authorization of the project, local interests must agree to:

a. Provide all necessary retaining dikes, bulkheads, and embankments at disposal sites, or the cost of such retaining works, including those required for construction of interior levees.

b. Provide necessary relocations or alterations.

c. Hold and save the United States free from damages due to construction or operation of the selected plan of disposal, excluding damages due to fault or negligence of the United States or its contractors.

A letter which indicates the intent of the Commonwealth of Virginia to be local sponsor for the selected disposal area plan is contained in Appendix 2.

## *Plan Implementation*

The steps necessary to implement a plan for replacement of the Craney Island Disposal Area, Norfolk Harbor, Virginia, can be summarized as follows:

● The report is reviewed by the Corps of Engineers' North Atlantic Division, the Board of Engineers for Rivers and Harbors, and the Office of the Chief of Engineers.

● The Chief of Engineers transmits the report to the Governor of Virginia and interested Federal agencies for formal review and comment. Following the above state and interagency review, the final report of the Chief of Engineers is forwarded to the Secretary of the Army. The Secretary then seeks the comments of the Office of Management and Budget regarding the relationship of the project to the program of the President.

● Congressional authorization of the project is then required. This procedure includes appropriate review and hearings by the Public Works Committees.

● If the project is authorized, the Chief of Engineers then includes funds for advanced studies, design, and construction in his budgetary requests. The advanced studies include all design and construction investigations necessary for the selected plan, as well as all special studies mentioned previously.

● Pending Congressional approval of advanced studies for the selected plan, formal assurances of local cooperation are requested from non-Federal interests.

● Plans, specifications, and a detailed engineering estimate of cost are then prepared by the District Engineer, bids are invited and a construction contract is awarded. At this time, the necessary local actions, including payment of the cash contribution, are required.

Primarily, because of uncertainties surrounding the time to accomplish environmental studies, it is not possible to accurately estimate a schedule for the above steps. However, once the project

was authorized, initially funded, and necessary studies completed, it would be possible to complete detailed design within two years. Construction of the selected plan would be accomplished as expeditiously as funds were appropriated.

## *Views of Non-Federal Interests*

The various plans of disposal presented herein were coordinated with the following agencies of the Commonwealth of Virginia.

- Department of Commerce and Natural Resources.
- Virginia Port Authority.
- Division of State Planning and Community Affairs.
- Virginia Institute of Marine Science.
- City of Portsmouth.

Statements expressing the views and recommendations of these interests are contained in Appendix 2. Generally, all of the statements were favorable to the selected plan. Further, the statements acknowledge that the Westward Extension alternative is the logical and most acceptable alternative to implement after the selected plan.

On 10 September 1970, 1 June 1972, and 28 August 1974, public meetings were held to obtain views on the authorized study and the various plans being considered as possible replacements to the Craney

Island Disposal Area. Notices of the meetings were furnished the United States Senators and Congressmen from the area, Federal and state agencies, city authorities, interested organizations, and private interests. A good deal of opposition was expressed at all meetings regarding the plans for a Westward Extension to the existing Craney Island. The remarks of opposition came from parties in residential areas near the site in question and from the city of Portsmouth. The main points of opposition included the following:

- The citizens of Portsmouth would be deprived of the beneficial use of a presently available natural harbor area.
- The existing environment of the area would be disturbed.
- The presence of noxious odors would be likely to continue.
- Residents along the waterfront would be adversely affected if odors continued, would experience a loss of access to the water, and would experience future use of the completed area possibly being incompatible with residential use.
- Drainage, now afforded by Streeter and Hoffer Creeks, would be impaired.
- Undeveloped land nearby would depreciate in value.
- The open water area of Hampton Roads would be further diminished.
- The pleasant view from the present shoreline would be detrimentally altered.

- Values of real estate in the area adjacent to Craney Island would be seriously affected.

The Commonwealth of Virginia has been advised that Federal participation in a plan to provide a replacement to the disposal area at Craney Island will be dependent upon fulfillment of the items of local cooperation listed in the sections "Division of Plan Responsibilities" and "Recommendations." A letter has been received from the Secretary of the Commonwealth's Department of Commerce and Natural Resources which expresses the state's understanding of its responsibilities as local sponsor. A copy of the letter is contained in Appendix 2.

In 1972, the Commonwealth of Virginia formed a task force to evaluate the question of spoil disposal, including the alternatives under detailed study by the Corps of Engineers. The resulting report, dated September 1973, recommends the continued use of the Craney Island site as the most practicable and acceptable plan, both ecologically and economically. According to the task force report, the continued use would be accomplished by raising the existing levees and thence by a two-phase construction of the Westward Extension alternative. This district concurs with the state's position on the selected plan to raise the levees. Concurrence is not offered for the Westward Extension, as it is felt the additional investigations indicated are necessary before a final, long-range determination is made.

Furthermore, in a May 1974 resolution, the City Council of Portsmouth, expressed strong opposition to the Westward Extension alternative.

# *Review by Other Federal Agencies*

The various plans of disposal under consideration were coordinated with the following Federal agencies.

- U. S. Fish and Wildlife Service.
- U. S. Environmental Protection Agency - Water Quality Office.

The views of the U. S. Fish and Wildlife Service are summarized by the following excerpts from a January 19, 1973 letter.

"Based on environmental considerations and in view of the potential damages to fish and wildlife resources, we recommend the raising of the existing Craney Island levees as being the least objectionable alternative. We recognize that a major disadvantage of raising the existing levees is that it would be a short-term solution to the problem of spoil disposal in the Hampton Roads area. However, it is salutary to reflect that each of the proposed alternatives, including the Nansemond County proposal with its 45-year project life, is also a short-term solution to what appears to be a perpetual disposal problem.

"The ultimate solution will not, in our opinion, be the containment of spoils and the unending search for new disposal areas, but will be dependent upon the discovery of beneficial uses of dredged material or at least methods to render polluted materials suitable for deep water ocean disposal. Although some advances have been made in this direction such as the use of suitable spoil for beach replenishment, much more needs to be done. Noteworthy of studies being conducted is a study by the Virginia Institute of Marine Science, to determine if pollutants such as nutrients, pesticides, and metals can be effectively removed from dredged material, thus allowing offshore disposal. In conjunction with this study, research is urgently needed to assess long-term detrimental effects of open water dumping of spoils in the ocean system.

"The additional time interval created by raising the Craney Island Disposal Area levees may provide sufficient time for technology to overcome the problems associated with ocean disposal of contaminated materials.

"The action recommended by the Bureau would serve as an interim, short-term solution, thus allowing an environmentally acceptable, long-range spoil disposal plan to be researched and developed. It would also provide time for such areas as Buckroe Beach to be tested in the Chesapeake Bay Model."

The views of the Environmental Protection Agency is summarized by the following excerpts from an April 4, 1973 letter.

"Raising levees at existing Craney Island Disposal Area. This alternative would be the least environmentally damaging. It would require no further commitment of resources and would utilize an area already degraded. Despite the short useful life span, estimated to be an additional 15 years and a capacity of 55 to 60 million cubic yards, this alternative seems the most viable and the most environmentally acceptable.

"Use of alternatives 3 (Westward Extension) and 4 (Raising levees) would allow for future changes in technology. Hopefully, a better utilization of spoil material will be found. By building the extension in sections, a more flexible design which could be modified to suit hydrological, aesthetic or ecological considerations.

"In addition to the alternative actions discussed, there is one that could provide a truly long term disposal area. This would be off Buckroe Beach, in the area known as The Horseshoe. We understand that considerable study would be required before consideration could be given to this site."

# Summary

The Hampton Roads area is a rapidly expanding metropolitan area whose economy has long been anchored in port and related activities. Through the years, the number and size of ships using the harbor for defense and commerce have gradually increased. Natural water depths in the harbor became inadequate, a condition which prompted the use of mechanical dredges. As channels in the harbor were deepened, then redredged periodically to maintain desired depths, the problem of what to do with material removed during the dredging process became more acute.

A number of different disposal areas had been used when, in 1945, the Congress authorized construction of the Craney Island Disposal Area. Construction of the area was completed in 1957. Today, the 125 million cubic yard capacity of Craney Island is within 5 or 6 years of being reached. Realization of the impending need prompted the Congress to authorize this study for determining a replacement for the Craney Island Disposal Area.

Some 17 various methods and locations for disposing of dredged material have been explored. Seven of these were discarded because of severe environmental impacts, high costs, or difficulties of construction. In the formulation portion of this study, some 9 possible plans were developed. These plans were evaluated in terms of their responsiveness to stated problems and needs, conformity to study objectives and formulation criteria, and comparison with other possible solutions.

None of the nine plans considered in detail are responsive to all problems and needs in the study area. There is a wide variance

in useful life among the plans. Moreover, there are major uncertainties with eight of the nine, which require further study. The plan to raise levees at the existing site is short-lived (11 years), but would provide necessary time for the additional study of other possibilities. Of the nine plans, this plan would involve the least environmental and social impacts. The plan would also be the most favorable economically, and the Commonwealth of Virginia has concurred in the plan's selection.

In keeping with the original intent of Congressional authorization for this study (review reports to determine a suitable replacement for Craney Island) and the fact that certain environmental, social impacts, and other studies are necessary before plan implementation, responsibility for such studies will continue to be that of the United States. In view of the construction capabilities of the Corps of Engineers and the precedent established in developing the original disposal area at Craney Island, construction of the selected replacement would be accomplished by the United States, after Congressional approval and funding, and after receipt of the non-Federal share of project cost. Actually, the Federal Government would have no financial responsibility toward the construction cost of the proposed improvement. Non-Federal interests would therefore be required to furnish 100 percent of the annual construction cost. Currently, the present worth of the construction cost is estimated to be \$1,900,000. Construction of Part I would be accomplished gradually as the need develops. The operation and maintenance of the elevated facility would be under the supervision of the Norfolk District.

Local interests (Commonwealth of Virginia) are aware of their responsibilities in this matter. A copy of the state's letter of

intent is contained in Appendix 2. Remarks of Federal agencies concerning the various plans are also in Appendix 2.

## *Statement of Findings*

I have reviewed and evaluated, in light of the overall public interest, documents concerning the proposed action, as well as the views of other agencies and the general public, relative to the various alternatives for replacing or extending the Craney Island Disposal Area (Norfolk Harbor), Virginia.

The consequences of all reasonable alternatives have been identified to the extent possible at this time. Each alternative plan has been studied and evaluated according to engineering feasibility, environmental effects, social well-being, and economic factors, including regional and national development. The major factors bearing on my review were the critical need for maintenance dredging (and disposal) in the regional harbor area, the foreseeable needs for additional deepening of the harbor's channels and anchorages, and the equally critical needs for protection and preservation of the extensive marine and other environmental resources in the harbor. I believe the course of action which I am recommending is the best one to follow, considering the needs just mentioned.

With regard to all factors mentioned, the following points were considered pertinent to my review and evaluation.

- ENGINEERING CONSIDERATIONS In the formulation phase of the Craney Island survey, 17 alternatives were considered. The technical criteria of useful life or total capacity needed was based on

an annual input from normal maintenance activities of 3.8 million cubic yards together with an estimated lump sum input of 137 million cubic yards to be generated by proposed deepening of the harbor's major channels and anchorages. There was a wide variance in useful lives of the alternatives considered. Useful lives among the nine alternatives examined in detail ranged between six years for the Westward Extension alternative to an unrestricted life for the ocean disposal plan. In the final analysis, I am recommending a plan which would last for about 11 years, based on the expected annual input of 3.8 million cubic yards. This plan would not be capable of accommodating the lump sum input of new work. Therefore, I am recommending the continued study of at least eight other alternatives. Any of these plans would be sensitive to all disposal needs in Hampton Roads for a period of about 40 years or more.

● ENVIRONMENTAL CONSIDERATIONS. The act of dredging and the disposal of dredged material has an impact on the environment. The environmental aspects of each of the various disposal alternatives were evaluated. The plan of immediate action I am recommending possesses the least adverse environmental impacts of any alternatives considered. I am concerned about the possible adverse effects of several other long-range plans to be considered. For that reason, I believe that additional, detailed studies are needed before a long-range plan is selected.

● ECONOMIC CONSIDERATIONS. On the basis of a partial benefit analysis, the selected plan, as well as each of the alternatives considered, has been found to be economically justified, by a very favorable margin.

● SOCIAL CONSIDERATIONS. The conceivable economic value of an adequately deepened and properly maintained channel network in Hampton Roads is indicative of the similar value of a disposal area in relation to social well-being in the area. Man's concern over protection of environmental resources, and the environmental protection afforded by confined, rather than open water disposal, is also viewed as being of social value. Adverse social impacts, particularly in the area immediately surrounding a disposal site, have been identified to the extent possible. However, I do not believe that sufficient detailed data has been developed regarding the social impacts of several long-range plans. I believe that such data is of such necessity that additional studies in this regard should be accomplished before a final decision is made. Nevertheless, I do not believe the social impacts of the plan I am recommending are severe enough to warrant delay or deferral of the plan's implementation.

I find that the action, as proposed in my recommendations, is based on thorough analysis and evaluation of various practicable alternative courses of action.

## *Recommendations*

It is recommended that the existing project for Norfolk Harbor, Virginia be modified to provide for a replacement to the Craney Island Disposal Area. The plan of replacement calls for the continued use of the existing area for a period of about 11 years, to be accomplished by gradually increasing the elevation of containment levees as the capacity need develops. Additional studies are recommended on several other plans of disposal, at an estimated cost of

\$4,000,000. The additional studies will be accomplished by the United States and will permit selection of a long-range disposal plan sensitive to foreseeable disposal needs in Hampton Roads for a period of about 40 years. The immediate action plan recommended herein, and the long-range plan to be selected after additional study, together will provide a 50-year plan of replacement for the existing Craney Island Disposal Area. The selected plan shall have such modifications as in the discretion of the Chief of Engineers may be advisable. Local interests (the Commonwealth of Virginia) will be required to furnish 100 percent of the funds for modification and annual maintenance, including those required for construction of interior levees at the existing site. These funds will amount to \$240,000 annually. The United States shall assume responsibility for operation of the facility, at an estimated annual cost of \$153,000. When all filling at the existing Craney Island Disposal Area is completed, title to the Area will be conveyed to the Commonwealth of Virginia whereupon payment of \$2.5 million will be required. Prior to relocation and raising of levees, the Chief of Engineers shall determine the exact dimensions of the parcel of land to be left along the north and east levees of the Area. When that determination is made, development of the parcel will be permitted, providing such development is feasible, does not conflict with filling operations in the adjacent area, and has need of the deep water access available.

The plan will be implemented, provided that, prior to the commencement of construction, non-Federal interests will agree to:

- a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers. This will include the necessary retaining dikes, bulkheads, and embankments therefor, or the

costs of such retaining works, all at a presently estimated annual construction cost of \$240,000.

b. Accomplish without cost to the United States all alterations and relocations of buildings, transportation facilities (excluding railroad, combined highway and railroad, and publicly-owned highway bridges and approaches thereto), storm drains, utilities, and other structures and improvements made necessary by the construction.

c. Enter into a written agreement satisfactory to the Secretary of the Army concerning accomplishment of the above pre-construction requirements, and agreeing that they will:

(1) Hold and save the United States free from damages due to construction and subsequent operation and maintenance works, excluding damages due to fault or negligence of the United States or its contractors.

(2) Hold and save the United States free from damages resulting to shellfish beds, wharves, and buildings, and resulting from changes in ground water levels and wave action due to the construction works.



ROBERT L. AYERS  
Colonel, Corps of Engineers  
District Engineer

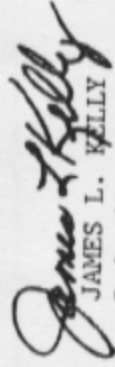
NADDE (4 Oct 74) 1st Ind

SUBJECT: Crane Island Disposal Area, Norfolk Harbor, VA

DA, North Atlantic Division, Corps of Engineers, 90 Church Street  
New York, New York 10007 5 December 1974

TO: HQDA (DAEN-BR/Resident Member) Kingman Bldg., Ft Belvoir, VA 22060

I concur in the conclusions and recommendations of the District Engineer.



JAMES L. KELLY  
Brigadier General, USA  
Division Engineer





